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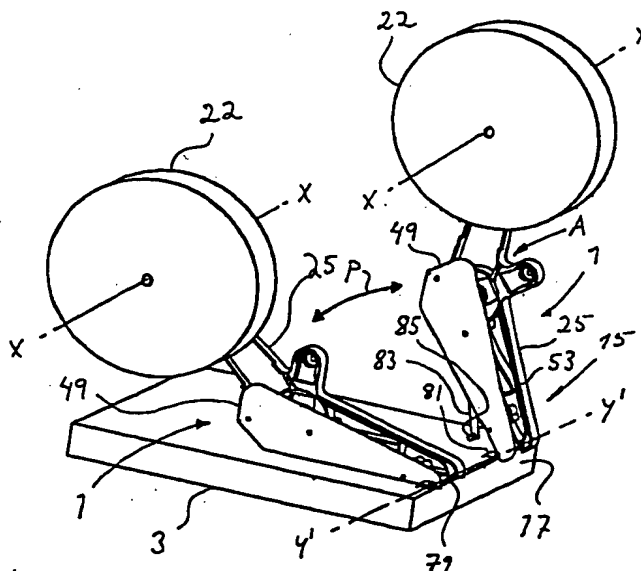
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **MOVEABLE FEEDER DEVICE**



(57) Abstract: Feeder module comprising a front section (15) and a rear section (19), which feeder module (1) is designed for feeding a transport tape (29) in the direction of the rear section (19) to the front section (15) with parts to be picked, which feeder module (1) can be mounted on a surface (4), such as a table top (5) or similar surface, with an edge (16), such as a table edge (17), in which the front section (15) is located close to an edge (16) and a storage unit (21) designed to store the transport tape (29) is free to rotate about an axle (x-x) on the feeder module (1). The axle x-x, in a working position, is located within the zone of the rear section (19) of the feeder module (1) and, in a starting position, is located close to a vertical line (L) coinciding with the edge (16).



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Moveable feeder device.

5 The present invention relates to a feeder module as described in the introduction to patent claim 1. The invention also relates to a procedure for replacing one storage unit with another in a feeder module.

10 The invention may be attributed to the assembly industry but is not confined to that area. Feeder modules, such as the 'tape and reel' type, are used to feed transport tapes, also referred to in this application as 'tapes', carrying packaged elements, such as parts for manufacturing industry, to a fixed position, known as a picking position, for a robot device or operator at the feeder module. The tape is provided with pockets, in which the parts are packaged, and is delivered to an assembly shop wound on a
15 transport tape reel. In this application, the transport tape reel is also referred to as a storage unit. The operator mounts the transport tape reel on the mounting device of the feeder module, which may consist of an arm incorporating an axle. One end of the tape is then inserted in the feeder module and the tape is fed forward successively with the aid of drive sprockets in the feeder module, while a welded or bonded cover strip
20 is simultaneously pulled away from the tape. The parts may be picked from their respective pockets as the cover strip is removed from the tape. When all of the pockets in the tape are empty of parts, the empty transport tape reel is removed and replaced with a new reel containing fresh parts for picking.

25 To achieve efficiency, several feeder modules are mounted on a common table. In this case, the feeder modules are located alongside each other and the operator operates several feeder modules on one and the same table. Up to 5-6 feeder modules may be mounted on one and the same table.

30 A feeder module is known according to US 5 725 140. Feeder modules of this type generally suffer from the disadvantage of being awkward to operate when the transport tape reel must be changed. In other words, to change the transport tape reel, the operator is obliged to go around the table on which the feeder modules are mounted.

Alternatively, the operator may lean across the table which, however, creates a risk of occupational injury. Major costs are associated with these advantages.

The purpose of the present invention is to facilitate the operation of changing the tape reel on the feeder module in order to achieve cost savings.

Another feeder module, described in the international patent application bearing the application number PCT/SE00/00014, features grooves in which the edges of the tape run as it is fed forward. This feeder module functions satisfactorily. A further purpose of the present invention is to further develop the feeder module described in PCT/SE00/00014.

The purpose is also to achieve a feeder module which facilitates mounting and removal of the associated transport tape reel, whereby the edges of the tape can be inserted easily in grooves in a time-saving manner.

This is achieved by means of a feeder module of the type described in the introduction, in which the shaft, in a working position, is located within the zone of the rear section of the feeder module and, in a starting position, is located close to at least one vertical line coinciding with the edge.

Further applications for and characteristics of the invention are described in the other patent claims.

A feeder module of this type ensures that the operator does not have to go around the table to replace the used transport tape reel with a new reel. Neither does the operator need to lean across the table and feeder unit for this purpose. Thus, a feeder module in accordance with the present invention enables the incidence of occupational injuries suffered by assembly shop operators involved in feeding transport tape reels and picking elements from them to be reduced. The feeder module in accordance with the invention also ensures that cost savings are achieved, while the time taken by the operator to change transport tape reels can be reduced. A feeder module of this type also ensures that the operator, in a favourable working posture, can insert one end of the transport tape in the feeder module grooves. In known technology, the operator is

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obliged to lean across the table to grasp the end of the tape and insert it in the grooves for feeding purposes.

5 The purpose of the invention is also to achieve a procedure for changing transport tape reels in a feeder module, which procedure facilitates mounting and removal of a transport tape reel in the said feeder module, the edges of the reel being inserted easily in grooves in a time-saving manner.

This is achieved by means of the procedure described in claim 9.

10 A procedure of this type ensures that the operator does not need to go around the table to change the tape reel. Neither is the operator required to lean across the table and feeder unit for this purpose. A procedure of this type also ensures that the operator, in a favourable working posture, can insert one end of the tape reel in the feeder module
15 grooves.

The invention will be described in further detail below with the aid of typical embodiments, with reference to the appended figures, of which

20 Fig. 1 is a schematic, perspective view of a feeder module in accordance with known technology;

Fig. 2 is a schematic, perspective view of a feeder module in accordance with the invention in a first embodiment;

25 Fig. 3 is a schematic elevation of the feeder module shown in Fig. 2:

Fig. 4 is a schematic, perspective view of a feeder module in accordance with the invention in a second embodiment;

30 Fig. 5 is a schematic elevation of the feeder module shown in Fig. 4:

Fig. 6 is a schematic, perspective view of a feeder module in accordance with the invention in a third embodiment, in a working position;

Fig. 7 is a perspective view of the feeder module shown in Fig. 6, in a starting position:

Fig. 8 is a schematic view of an mounting device on the feeder module, and

Fig. 9 is a schematic view, partially sectioned, of a shaft for mounting a transport tape reel.

Terms such as 'upward' and 'downward' used in this description indicate directions in general, the feeder module in the figures being shown in an upright position, that is, in a working position or a starting position. For the sake of clarity, details not essential to the invention are omitted from the figures.

Fig. 1 is a schematic, perspective view of a feeder module in accordance with known technology. The feeder module 1 is mounted on a table 3 (indicated by the dashed lines) and is held in position against a surface 4, such as a table top 5, by a clamp 7. The feeder module 1 is secured to the table 3 with the aid of the clamp 7, which consists of a backing plate 9 and an angle rod 11 provided with a screw thread (not shown) to accommodate a wing nut 13. A front section 15 of the feeder module 1 is located close to an edge 16, such as a table edge, 17, of the table 3. A rear section 19 incorporates an mounting device 20, on which a mountable and removable storage unit 21, such as a transport tape reel 22, is mounted. The mounting device 20 incorporates an arm 23, which forms part of a first side piece 25. The transport tape reel 22 incorporates a bearing sleeve 27, which permits the transport tape reel 22 to rotate on an axle x carried by the arm 23. A transport tape 29 is wound on the transport tape reel 22 between two flanges 31.

In a working position, the transport tape 29 is fed to a picking position u, where elements (not shown) packaged in the transport tape 29 can be picked. The elements are packaged in pockets 33 in the tape 29. A cover strip 35 is pulled off with the aid of the feeder module 1 and is wound onto a takeup reel 37. The purpose of the cover strip 35 is to protect the elements from dirt and dust while stored on the tape 29.

A number of feeder modules 1 can be mounted side by side on a common table 3. Working at 0, an operator has the duties of picking the elements and changing the transport tape reel 22 on the feeder modules 1. A transport tape reel 22 is changed when all of the elements have been picked from the pockets 33 in the tape 29, the empty transport tape reel 22 being replaced by a new transport tape reel 22 containing a fresh supply of elements.

A feeder unit 99 (not shown in Fig. 1) is arranged in a central section of the feeder module 1. A drive sprocket (not shown) with teeth 43 engage holes 45 in the tape 29. The feeder unit is not shown since it is concealed by the first side piece 25 and a second side piece 49. However, the feeder unit 99 is visible in Figs. 6 and 7. The feeder unit 99 is housed essentially within the first side piece 25. Three screws 51 are used to attach the second side piece 49 to the first side piece 25. The second side piece is 5 mm thick.

Grooves 53 are formed along the length of the two side pieces 25, 49, in the sides of the pieces facing each other. The grooves 53 extend in a direction of feed F. The grooves 53 are shown more clearly in Fig. 2.

The grooves 53 are designed to accommodate the edges 55 of the tape 29. The grooves 53 may be 3 mm in depth and 1 mm in width to accommodate the edges 55, so that the friction of the feeding action is as low as possible. Thus, the width of the tape 29 is determined approximately by the distance between the bottoms (not shown) of the grooves 53.

As seen in Fig. 1, the grooves 53 turn downward at the front end 15 of the feeder module 1, that is, at that end of the feeder module 1 at which the elements can be picked from the pockets 33. This bend is denoted C. The tops of the side pieces 25, 49 are designed so that they follow the curvature of the grooves 53.

To change the transport tape reel 22, the operator is obliged to lean across the table 3 to remove the empty transport tape reel 22. The operator must then again lean across the table 3 to mount the new transport tape reel 22 on the mounting device 20. This creates a risk of occupational injury and is also time-consuming. In addition, the

operator must grasp one end 57 of the tape 29 to insert it in the grooves 53 at position A in order to feed the tape forward. This means that the operator must again lean across the table 3 to grasp the end 57 of the tape when this is close to the transport tape reel 22. Forward feeding of the tape can be commenced when the operator has inserted the end 57 of the tape at position A and pushed it forward as far as the drive sprocket and teeth 43, so that the teeth 43 engage the holes 45.

Fig. 2 is a schematic, perspective view of a feeder module as a first embodiment in accordance with the invention. The feeder module 1 is mounted on a table top 5. The feeder module 1 incorporates a front section 15 and a rear section 19. The front section 15 is located close to the edge 16 of the table top 5, such as a table edge 17.

Only the first side piece 25 is illustrated in Fig. 2. The feeder mechanism and drive motor are not illustrated. The feeder module 1 shown in Fig. 2 is, in accordance with the present invention, a further development of the feeder module 1 shown in Fig. 1.

In this first embodiment, the mounting device 20 is pivoted about a pivot pin y-y. In the working position, the mounting device 20, such as an arm 59, constitutes an extension of the first side piece 25. The storage unit 21, that is, the transport tape reel 22, is free to rotate about an axle x-x. The mounting device 20 connects the axle x-x with the first side piece 25 through the pivot pin y-y, which consists of a pin bolt 61 passing through drilled holes 63 in both the mounting device 20 and the first side piece 25. Both ends of the pin bolt 61 are threaded and fitted with nuts (not shown).

The transport tape reel 22 and mounting device 20 are shown in a working position indicated by dashed lines. The solid lines show the transport tape reel 22 and mounting device 20 in a starting position, in which the tape reel 22 is to be changed. In Fig. 1, the transport tape reel 22 is shown lowered against the front section 15 of the feeder module 1 and to a position closer to the table edge 17.

Fig. 3 is an elevation of the feeder module 1 in the first embodiment. This clearly shows the starting position (solid line) and the working position (dashed line) of the transport tape reel 22. In the starting position, a horizontal axle x-x is located close to at least one vertical line L coinciding with the table edge 17. The axle x-x is located

horizontally across the direction of feed F. The extended axis of the axle x-x coincides with a second pin bolt 65, which passes through a drilled hole in the arm 59. One end of the pin bolt 65 is attached to one end of the arm 59, while the other end is threaded (not shown). A wing nut (not shown) can be mounted on the second pin bolt 65 and holds the tape reel 22 axially as shown by known technology in Fig. 1.

In the starting position, the end 57 of the tape 29 is ready for insertion in the grooves 53 in the feeder module 1. In the working position, the transport tape 29 runs from the transport tape reel 22 to the grooves 53 and are fed forward to the picking position u. The transport tape 29 is fed forward by a feeder device which is of known technology. The feeder device is controlled by the operator or by a computer (not shown).

A latching device 67, comprising a chamfered pawl 69, a spring 71, a cable 73 with a draw loop 75 and a notch 77, ensure that the mounting device 20 is locked in the working position. To move the mounting device 20 to the starting position, the operator pulls on the draw loop 75 to release the pawl 69 from the notch 77 in the mounting device 20. The chamfered surface on the pawl 69 enables the mounting device 20 to be moved to the working position and locked in that position without requiring the operator to operate the pawl 69, the spring 71 acting to press the pawl 69 into the notch and holding it in position.

Figs. 4 and 5 show a feeder module 1 in a second embodiment. In this embodiment, the entire feeder module 1 can be tilted about an axle y'-y'. This axle y'-y' is located at the front section 15 adjacent to the table edge 17. Details in Figs. 4 and 5 indicated by reference designations which have been explained already correspond to the details thus explained.

The axle y'-y' consists of a third pin bolt 79 with threaded ends, which pin bolt passes through the front section 15 and brackets 81 bolted to the table 3. Nuts (not shown) are screwed onto the pin bolt 79 to the outside of the brackets 81, thereby holding the pin bolt 79 in position. Several different types of axle design are possible.

Two feeder modules 1 are mounted side by side on the table 3. The feeder modules 1 can be tilted in the direction of the arrow p. An air cylinder 83 is clearly visible behind

the raised feeder module 1, which air cylinder is attached both to the first side piece 25 and to the table 3, and is free to pivot about attachment points 85. The air cylinder 83 may be of a known type or may consist, for example, of a gas strut of the type used on the boot lids of modern cars.

5 The internal grooves 53 in which the tape (not shown in Fig. 4; see Fig. 1 and explanation of known feeder module) is intended to run are provided in the respective side pieces 25, 49. In the raised position (starting position), the operator can insert the end (57 in Fig. 1) of the tape in the grooves 53 at position A, easily and without the
10 necessity of leaning across the table 3. A handle 84 is attached to the second side piece 49 to assist the operator in raising the feeder module 1 to the starting position.

Figs. 6 and 7 show a feeder module 1 in a third embodiment. In this embodiment, the entire feeder module 1 can be repositioned relative to the table edge 17. Fig. 6 shows
15 the feeder module 1 in an inner position, the working position, while Fig. 7 shows an outer position, the starting position. In the starting position, the axle x-x is located close to the line L, enabling the transport tape reel 22 to be changed easily. The axle x-x is of the same type as that described in the description of the feeder module 1 in the first embodiment and, therefore, is not described in detail below.

20 The feeder module 1 is provided with a guide device, such as the slide rails 87. The slide rails 87 are of currently existing types. The slide rails 87 illustrated in Fig. 6 and Fig. 7 are of the type, known as telescopic rails, used on conventional filing cabinet drawers. A pin (not shown) inserted in a drilling through the slide rail 87 and table 3 is
25 used to lock the feeder module 1.

The feeder unit 99 incorporated in the feeder module 1 consists of a drive motor 101 with a drive sprocket 100 for feeding the tape (see Fig. 1), the teeth 43 of the drive sprocket 100 being arranged to engage in the holes 45 (see also Fig. 1).

30 Fig. 8 shows a section of the mounting device 20, which is designed to carry the transport tape reel 22. Fig. 9 shows an axle 101 of the transport tape reel 22, with a guide roller 102. The guide roller 102 incorporates a guide axle 105, and an inner and outer flange 103. The guide roller 102 is free to rotate relative to the axle 101 in a

roller bearing 106, the guide axle 105 being supported by the roller bearing 106, which is seated in the axle 101. The roller bearing 106 is shrunk onto the guide axle 105. A stop washer 110 is used to secure the guide roller 102 on the transport tape reel axle. A stop flange 109 on the axle 101 of the transport tape reel 22 retains the transport tape reel 22 on the axle 101.

To mount a transport tape reel 22 on the feeder device, the operator places the said transport tape reel against the arm 59 with the guide roller 102 on the upper edge 111 of the arm 59. The operator then pushes the tape reel along the arm 59 until the guide roller 102 enters a cutout 107, in which the guide roller 102 is seated in the working position. Since the guide roller 102 is free to rotate relative to the transport reel 22, the guide roller 102 can roll along the edge 111, eliminating the need for the operator to lift the transport tape reel 22 to mount it in position. In the working position, the transport tape reel 22 then rotates about the axle x-x, together with the axle 101 of the transport tape reel 22, the guide roller remaining at rest in the cutout 107.

Other embodiments can naturally be realised within the framework of the invention. For example, the feeder module 1 can be mounted on a table 3 in such manner that, in the starting position, it (the feeder module) and the axle x-x are located well outside the table edge 17, as viewed from the rear section 19 in the direction of the front section 15.

The invention also includes a procedure for replacing one storage unit 21 with another in the feeder module 1. The procedure involves moving the mounting device 20 from a working position to a starting position, in which the axle x-x is located close to at least one vertical line L coinciding with the edge 16, removing the storage unit 21 without a transport tape 29, mounting a new storage unit 21 with a transport tape 29 on the axle x-x of the said mounting device 20, inserting one end 57 of the transport tape 29 in the feeder module 1 at position A, essentially between the front and rear sections 15, 19, and returning the mounting device 20 to the working position.

The procedure in accordance with the invention means that small-scale production lines can be equipped with 5-6 feeder modules mounted on a table top, enabling the elements to be picked from the tape in a flexible and cost-effective manner. Large-

scale production lines inhibit changes in production set-up and suffer from a lack of flexibility. Feeder modules designed for large-scale production lines are highly complex to operate.

Patent claims

1. Feeder module consisting of a front section (15) and a rear section (19), which feeder module (1) is designed for feeding a transport tape (29) in the direction of the rear section (19) to the front section (15) with parts to be picked, which feeder module (1) can be mounted on a surface (4), such as a table top (5) or similar surface with an edge (16), such as a table edge (17), in which the front section (15) is located close to an edge (16) and a storage unit (21) designed to store the transport tape (29) is free to rotate about an axle (x-x) on the feeder module (1), characterised in that the axle x-x, in a working position, is located within the zone of the rear section (19) of the feeder module (1) and, in a starting position, is located close to a vertical line (L) coinciding with the edge (16).
2. Feeder module as per claim 1, characterised in that the feeder module (1) incorporates side pieces (25, 49) with internal grooves (53), in which the edges (55) of the transport tape (29), in the working position, are located for feeding the tape (29).
3. Feeder module as per claim 2, characterised in that one end of the tape (29) stored in a storage unit (21) is located, in a starting position, in the area of the grooves (53).
4. Feeder module as per claims 1-3, characterised in that the feeder module (1) incorporating the axle (x-x) and mounting device (20) is mounted movably on the surface (4).
5. Feeder module as per claims 1-3, characterised in that the mounting device (20) is free to rotate about a horizontal axle (y-y), which axle (y-y) extends across a direction of feed (F) and to the extension of the tape (29) in the working position, and which axle (y-y) is located essentially between the front and rear sections (15, 19).
6. Feeder module as per claims 1-3, characterised in that the complete feeder module (1) can be tilted about an axle (y'-y') arranged at the front section (15).

7. Feeder module as per any of the foregoing claims, **characterised in that** the axle (x-x), in the starting position, is located essentially beyond the edge (16), as viewed from the rear section (19) in the direction of the front section (15).
- 5 8. Feeder module as per any of the foregoing claims, **characterised in that** the mounting device (20) is provided with a cutout (107) to accommodate a guide roller (102) on the transport tape reel (22), which guide roller (102) is free to rotate on an axle (101) on the transport tape reel (22).
- 10 9. Procedure for replacing one storage unit (21) with another in a feeder module (1) as per the foregoing claims, **characterised by** the following stages: movement of the mounting device (20) from a working position to a starting position, in which the axle (x-x) is located close to at least one vertical line (L) coinciding with the edge (16), removal of a storage unit (21) without a transport tape (29), mounting of a storage unit
- 15 (21) with a transport tape (29) on the axle (x-x) of the said mounting device (20), insertion of one end (57) of the transport tape (29) in the feeder module (1) at a position A located essentially between the front and rear sections (15, 19), and return of the mounting device (20) to the working position.

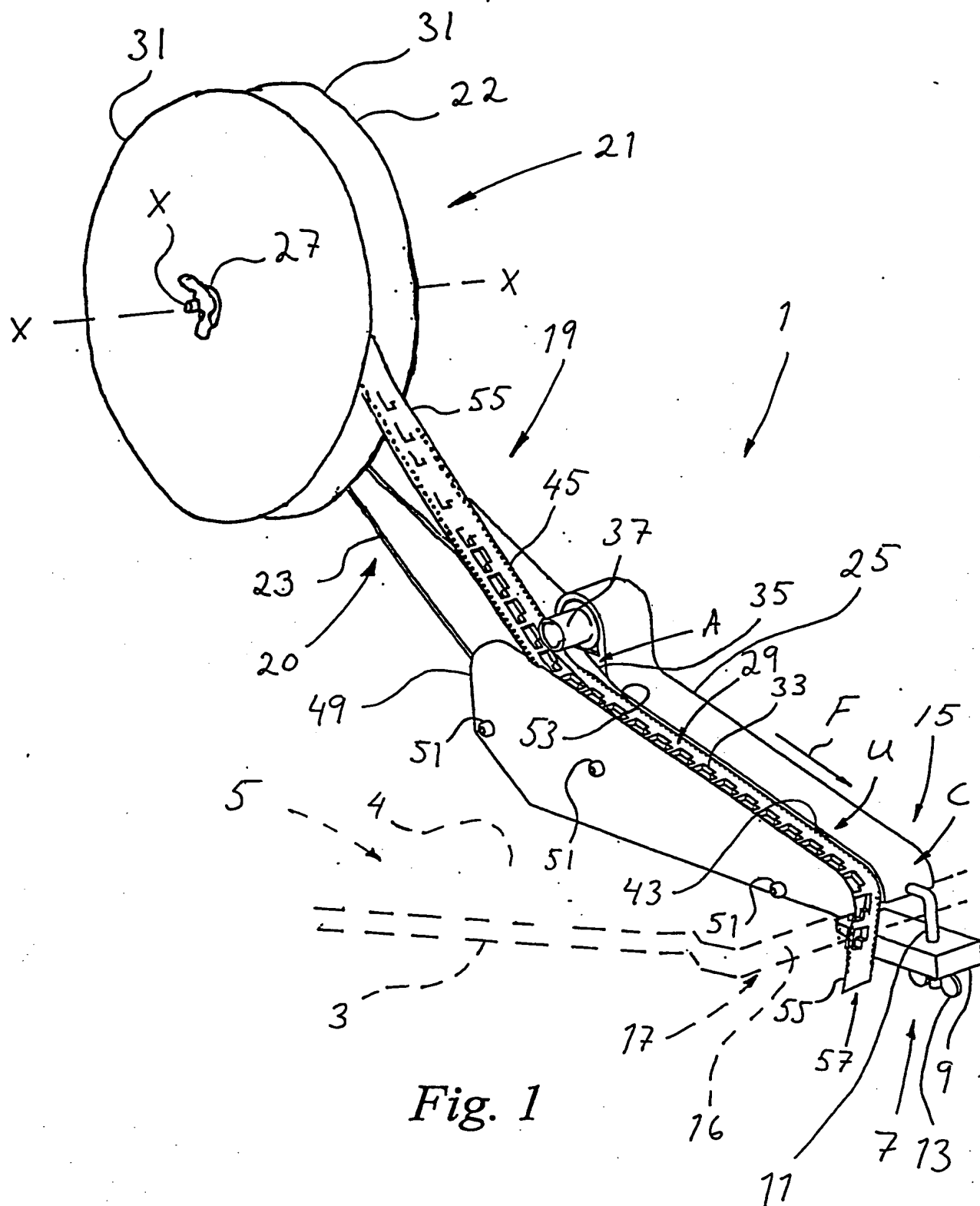


Fig. 1

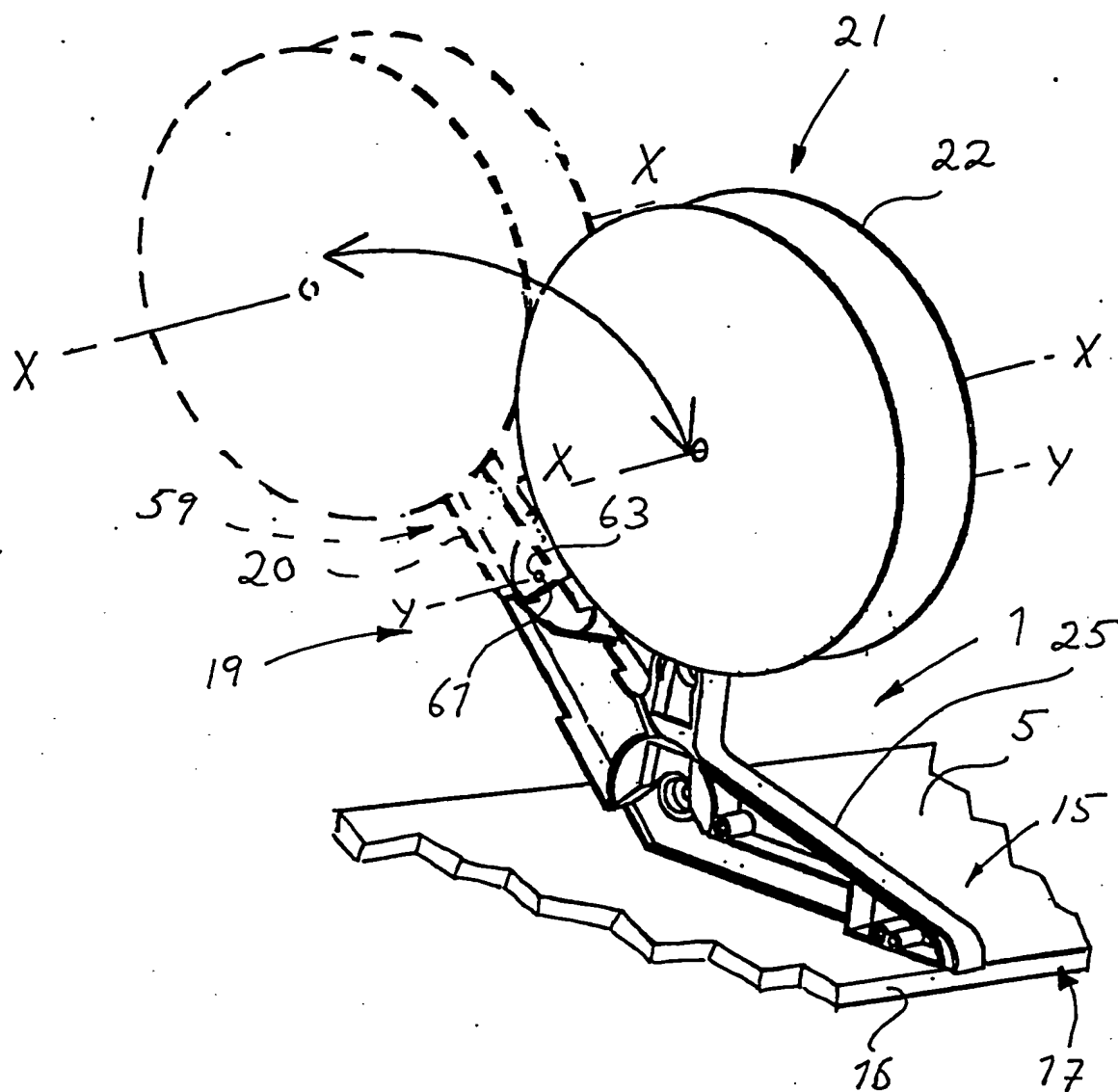


Fig. 2

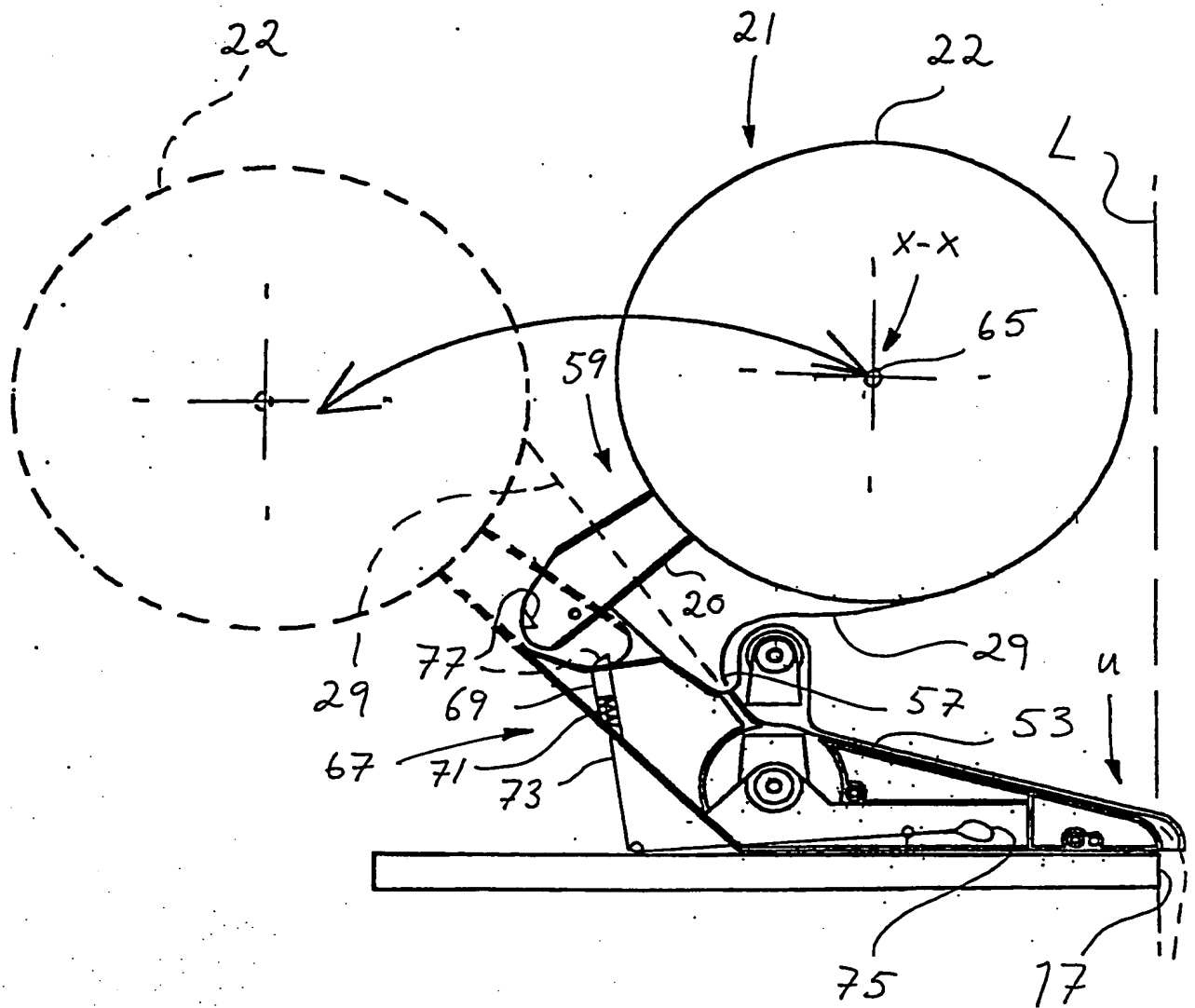


Fig. 3

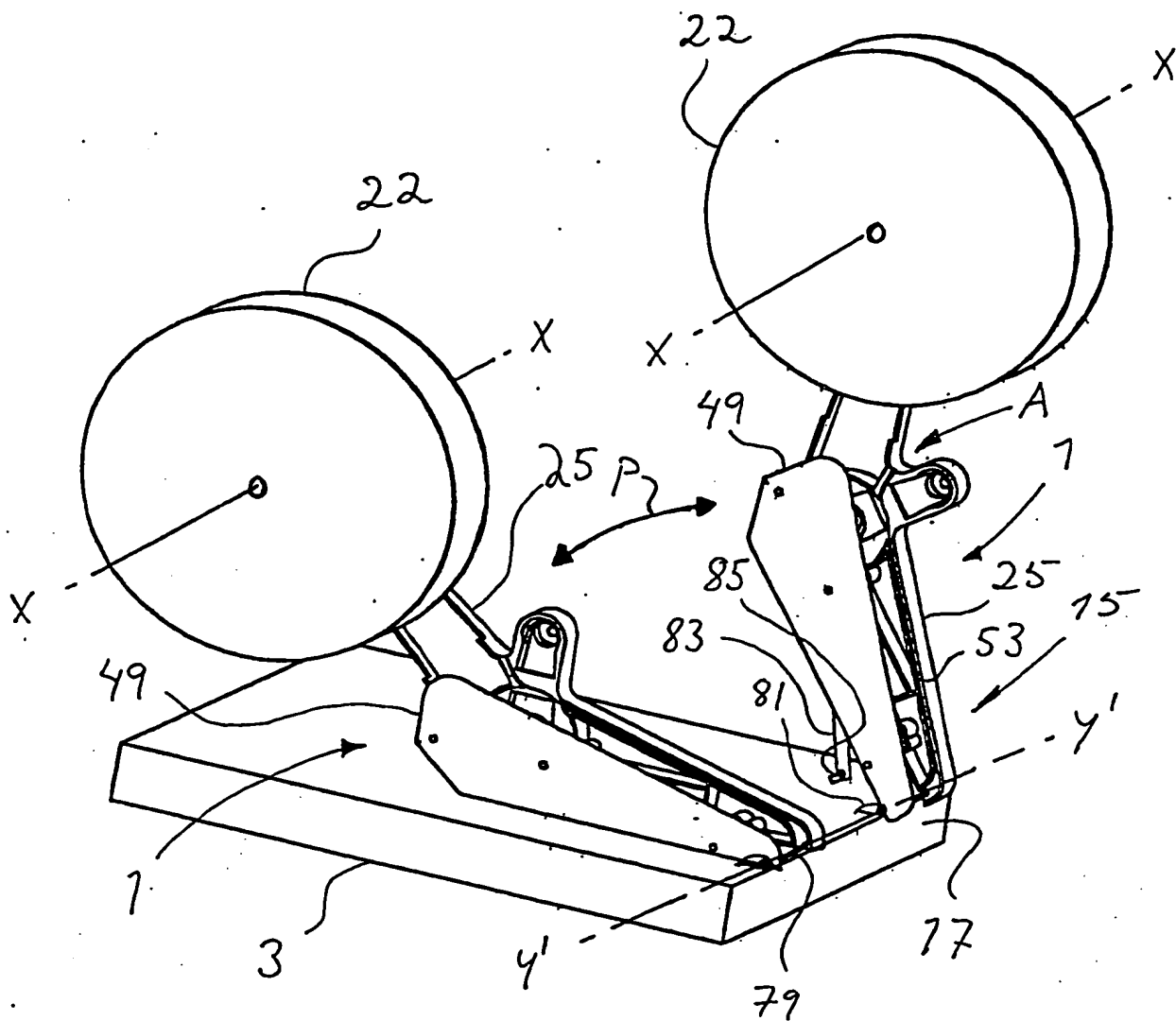
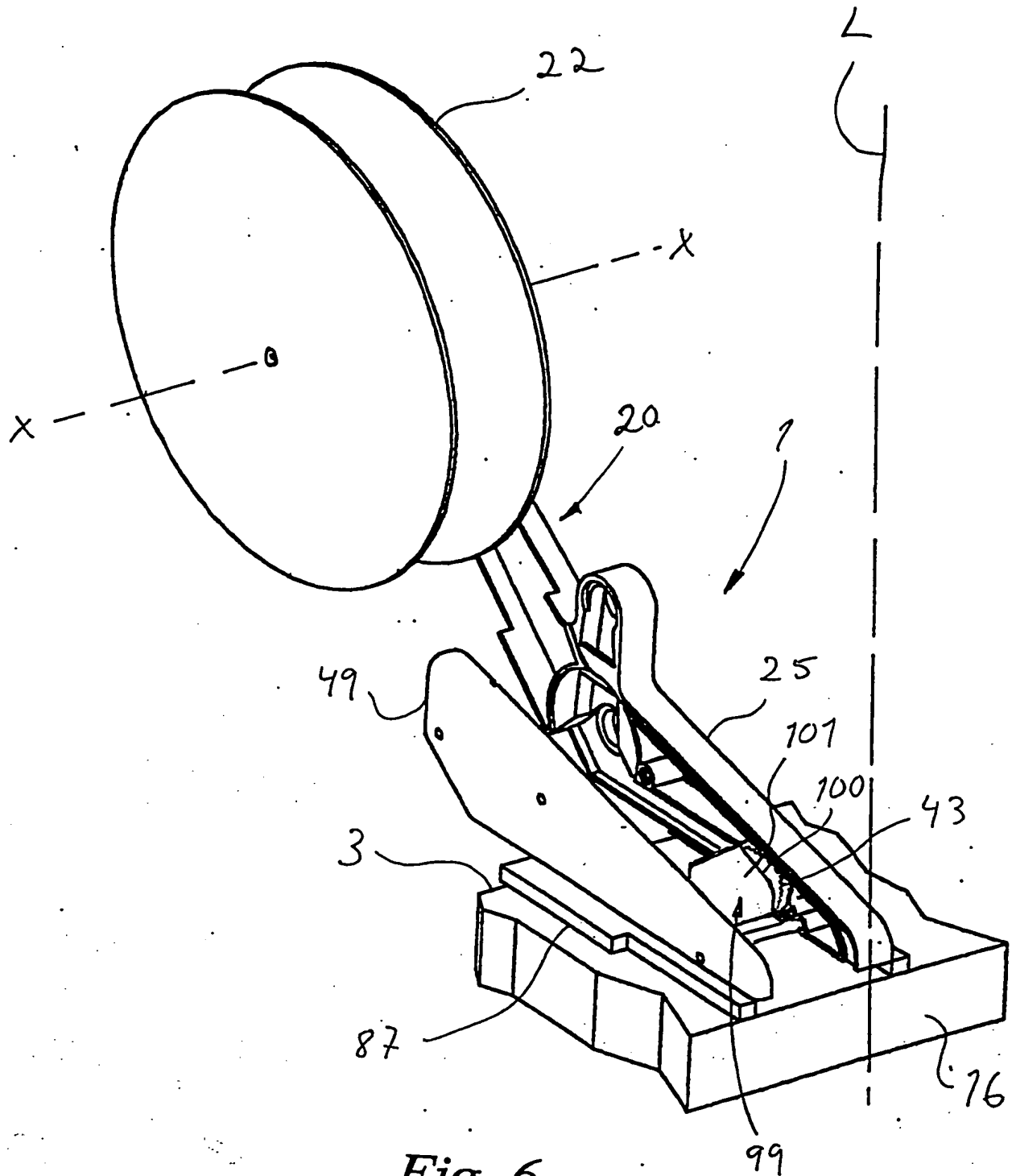
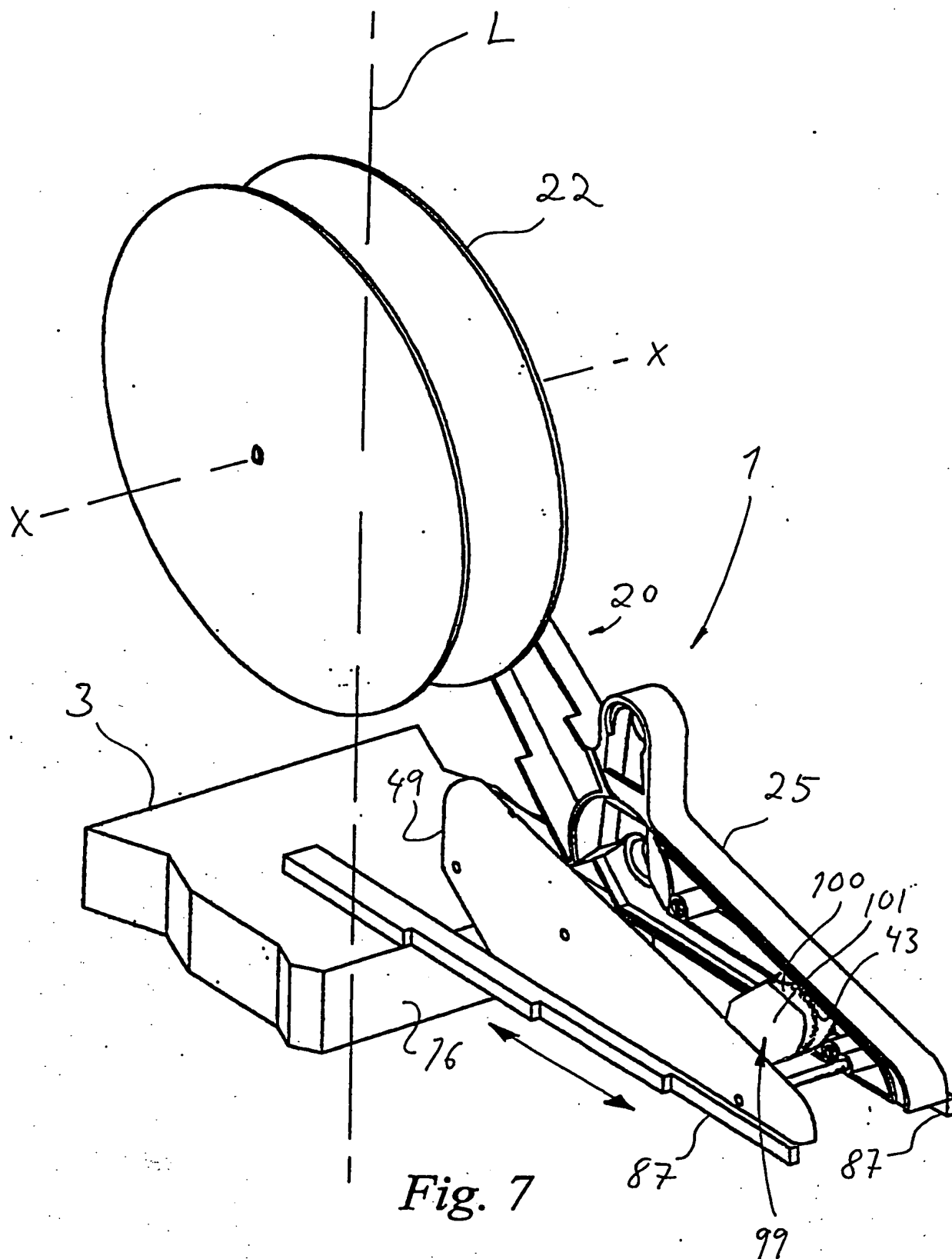


Fig. 4





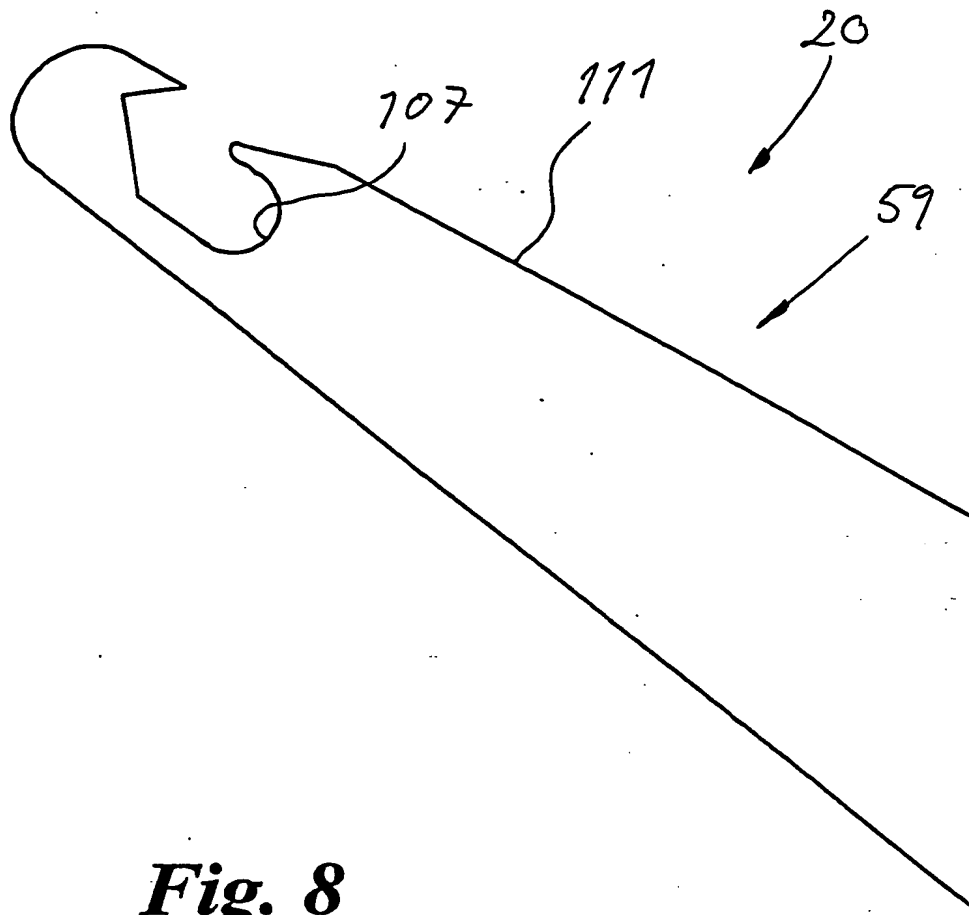


Fig. 8

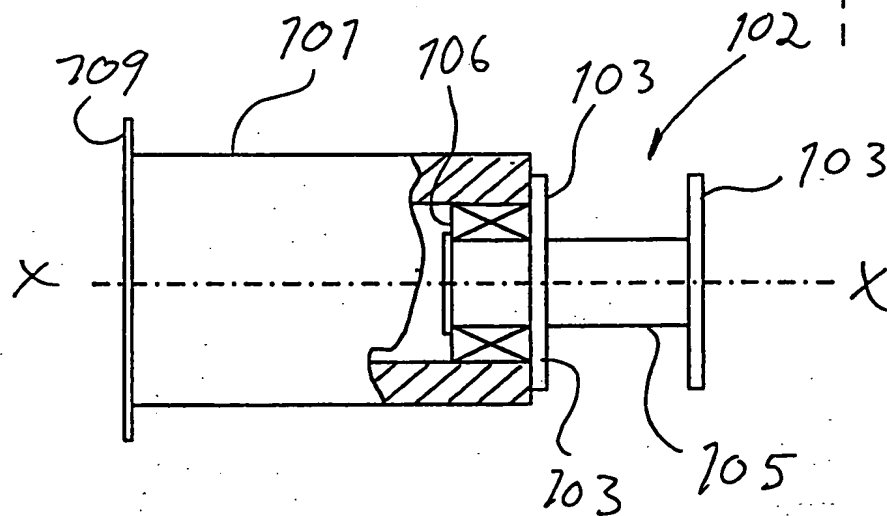


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 01/00629

A. CLASSIFICATION OF SUBJECT MATTER		
IPC7: B65H 37/00, H05K 13/04 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC7: B65H, H05K		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 5040737 A (LUDWIG ZERONI ET AL), 20 August 1991 (20.08.91), figure 1, abstract --	1,9
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A	US 5323528 A (STUART BAKER), 28 June 1994 (28.06.94), figure 2, abstract --	1-9
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
29 June 2001		04 -07- 2001
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INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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28/05/01

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